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FLOOD INSURANCE STUDY



CITY OF BISHOP,
TEXAS
NUECES COUNTY



OCTOBER 15, 1980



federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 480505

FEM 1.729

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY CITY OF BISHOP, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Bishop, Nueces County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Bishop to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Espey, Huston & Associates, Inc. for the Federal Insurance Administration, under Contract No. H-4786. This study was completed in July 1979.

1.3 Coordination

A meeting was held at the City of Bishop on May 12, 1978, attended by officials of Bishop, a representative of the FIA, and a representative of Espey, Huston & Associates, Inc. The meeting was held to explain the nature and purposes of the study, the scope and limits of the work, and to obtain any available flood information relevant to the study. A subsequent meeting was held with the City Administrator to discuss the flood prone areas and obtain flood information currently available concerning the community.

The U.S. Geological Survey (USGS) district office in San Antonio was contacted on the availability of stream gaging stations within the study area. No gage station data was found.

The U.S. Army Corps of Engineers (COE), Hydrology Division Office in Galveston, Texas, the Soil Conservation Service (SCS), in Robstown and Temple, Texas, the Nueces County Drainage District located in Robstown, Texas, and the Texas Department of Water Resources (TDWR) in Austin, Texas, were contacted to provide available flood information pertinent to the City of Bishop. No flood data applicable to the study area was found.

On May 27, 1980, the final coordination meeting was held in the City of Bishop to review the result of the study. This meeting was attended by representatives of the city, Espey, Huston & Associates, Inc. and representatives of the Dallas Regional Office of the FIA.

2.0 AREA STUDIED

2.1 Scope of Study

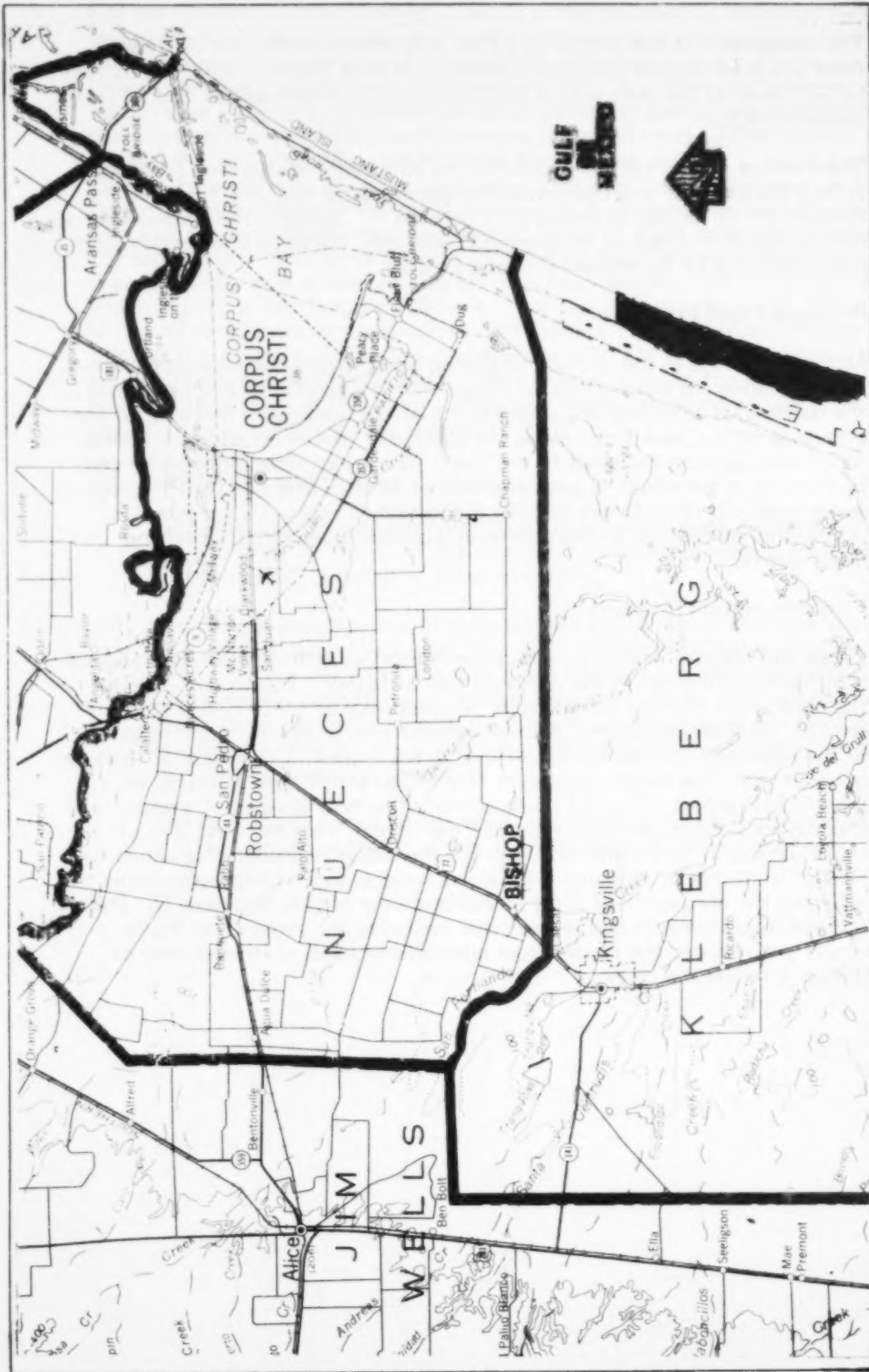
This Flood Insurance Study covers the incorporated area of the City of Bishop, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through December 1983.

2.2 Community Description

The City of Bishop is located in the southwest corner of Nueces County, Texas. Bishop is located approximately 6 miles northeast of the City of Kingsville in Kleberg County along U.S. Highway 77, and approximately 15 miles southwest of the City of Robstown in Nueces County along U.S. 77. Census data for 1960 indicated a population of 3,722 persons, a 36.3 percent increase over 1950. By 1970 the population had declined by 6.9 percent to 3,466 persons. In 1973 the census indicated a slight increase of 3 percent to a population of 3,573. Community officials commented that the population has stabilized since the 1970 census (Reference 1).

The city was incorporated in 1912. Since the move for incorporation the main commercial activities that support the economic life of the city are farming and industry. Cotton and sorghum grain are the main farm products of the city, and the Celanese Chemical Corporation and Celanese Plastic Company are the two supporting industries. Presently the city limits encase an area of approximately 1,550 acres.



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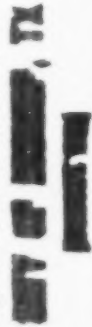


FIGURE 1

APPROXIMATE SCALE



VICINITY MAP

The topography of the city is very flat. Elevations within the city vary from a high of 62 feet National Geodetic Vertical Datum (NGVD) to 55 feet NGVD. Most of the area within the Bishop limits is between 61 and 58 feet above NGVD.

The average annual rainfall, based on the Kingsville Station for 26 years, is 26.5 inches. The average annual temperature for the city, based on the Kingsville Station for 26 years, is 72 degrees F. January, the coldest average month, has an average of 48 degrees F and July, the hottest average month, has an average of 96 degrees F (Reference 2).

2.3 Principal Flood Problems

Natural drainage in the vicinity of Bishop occurs from northwest to southeast following the natural ground slope. North Carretta Creek runs along the north edge of Bishop and drains much of the area north and west of the city. Carretta Creek flows along the south and southwest edges of Bishop and drains agricultural lands to the west. The major flooding experienced by the city is the result of poor drainage of storm waters and not the high water from Carretta Creek and North Carretta Creek. This problem is aggravated by the flat topography which causes rainwater to pond and drain slowly.

2.4 Flood Protection Measures

Levee and channel improvements along North Carretta Creek have reduced the flooding potential in the north portion of Bishop. A levee runs along the north edge of First Street from the west edge of the city limits to the U.S. 77 Business Route. A smaller levee runs along the south edge of the improved channel north of First Street from U.S. Business 77 to Hackberry Street. The major channel of North Carretta Creek is improved from U.S. Business 77 to the southeast city limits of Bishop. A smaller channel runs along the north edge of First Street from the west side of U.S. Business 77 to its intersection with the major improved channel at North First Street. This smaller channel handles much of the storm runoff from the area south of First Street and west of U.S. Business 77. The channel improvements and levees have improved the removal of storm runoff and reduced the runoff from agricultural lands north and west of Bishop entering the city.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Flood discharges for Carretta Creek and North Carretta Creek were based on the USGS open-file report 77-110, "Technique for Estimating the Magnitude and Frequency of Floods in Texas," which is a regional method based on regression analysis. The method relates drainage area and channel slope to the peak discharge by empirical equations (Reference 3). Peak discharges greater than the 100-year event were determined by straight line extrapolation on log-probability paper.

The peak discharge-drainage area relationships for each stream studied in detail are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
CARRETTA CREEK					
At U.S. Highway 77 Bypass located at 7,000 ft. down- stream of corporate limits	24.02	2,476	4,350	5,170	7,700
At Birch Avenue	22.99	2,399	4,210	5,000	7,500
North Avenue H	22.06	2,330	4,075	4,840	7,200
NORTH CARRETTA CREEK					
At Business U.S. Highway 77	5.48	760	1,170	1,335	1,780
At North Avenue C	3.73	575	870	985	1,310

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Cross sections for the backwater analyses of Carretta Creek and North Carretta Creek were obtained by field measurement. Dimensions of all bridges and culverts were obtained by field measurement and field checked to verify structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

The channel roughness coefficients (Mannings "n") used in the hydraulic computations were chosen by engineering judgement and based on field inspection of the streams and flood plains at each cross section. Roughness coefficients for the main channel of Carretta Creek range from 0.03 to 0.05 with flood plain roughness coefficients ranging from 0.05 to 0.08. For North Carretta Creek, main channel roughness coefficients range from 0.03 to 0.04 with flood plain roughness coefficients of 0.045.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 4). Starting water-surface elevations for Carretta Creek and North Carretta Creek were calculated using the slope-area methods. Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Areas affected by the 100- and 500-year floods were outlined by

using the width and water-surface elevation at each surveyed cross section and interpolating the width and elevation between sections using water-surface profiles and USGS topographic quadrangle maps (Reference 5).

All elevations are referenced from the National Geodetic Vertical Datum of 1929 formerly referred to as Sea Level Datum of 1929. Elevation reference marks used in this study are shown and described on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is used to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the flood elevations at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 5). In cases where the 100-year and the 500-year boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without

substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, widths were interpolated and boundaries drawn. In cases where the floodway and the 100-year boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE'	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Carretta Creek								
A*	1,850	132	815	6.3	39.5	39.5	39.5	0.0
B*	2,000	132	826	6.3	39.6	39.6	39.6	0.0
C*	2,050	198	1,216	4.3	40.1	40.1	40.1	0.0
D*	4,120	150	930	5.6	42.7	42.7	42.7	0.0
E*	4,220	121	985	5.2	43.0	43.0	43.1	0.1
F*	5,320	110	997	5.2	44.6	44.6	45.1	0.5
G	9,120	354	1,592	3.2	51.7	51.7	52.7	1.0
H	10,320	300	2,628	2.0	52.5	52.5	53.3	0.8
I	11,520	230	2,970	1.7	52.5	52.5	53.3	0.8
J	12,030	140	1,191	4.2	54.5	54.5	55.5	1.0
K	12,130	154	1,293	3.9	54.7	54.7	55.7	1.0
L	12,210	180	1,412	3.5	54.8	54.8	55.6	0.8
M	14,210	153	1,016	4.9	56.7	56.7	57.7	1.0
N*	15,610	410	2,314	2.1	57.8	57.8	58.8	1.0

'Feet above confluence with North Carretta Creek

*Outside corporate limits

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CITY OF BISHOP, TX

(QUECES CO.)

FLOODWAY DATA

CARRETTA CREEK

TABLE 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
North Carretta Creek	A*	0	826	2.3	46.8	46.8	47.8	1.0
	B*	1,500	903	2.1	48.0	48.0	48.5	0.5
	C*	2,860	722	2.6	48.9	48.9	49.2	0.3
	D*	4,300	648	2.9	50.5	50.5	50.6	0.1
	E*	5,930	751	2.5	52.1	52.1	52.1	0.0
	F*	7,130	146	659	2.3	52.6	52.6	0.0
	G*	8,130	164	889	1.7	52.8	52.8	0.0
	H*	8,330	150	873	1.8	52.9	52.9	0.0
	I	9,415	144	461	3.3	53.2	53.2	0.0
	J	9,665	129	802	1.9	53.4	53.4	0.0
	K	9,765	152	763	2.0	53.4	53.4	0.0
	L	10,425	138	487	3.1	53.8	53.8	0.0
	M	10,975	161	342	4.5	54.5	54.5	0.0
	N	12,005	143	302	4.4	57.2	57.2	0.0
	O	12,105	131	266	5.0	57.4	57.4	0.0
	P	12,255	92	610	2.2	58.0	58.0	0.0
	Q	13,970	130	291	3.4	60.1	60.1	0.0
R	15,270	155	396	2.5	61.6	62.6	1.0	
		196						

¹Feet above downstream limit of detailed study

*Outside corporate limits

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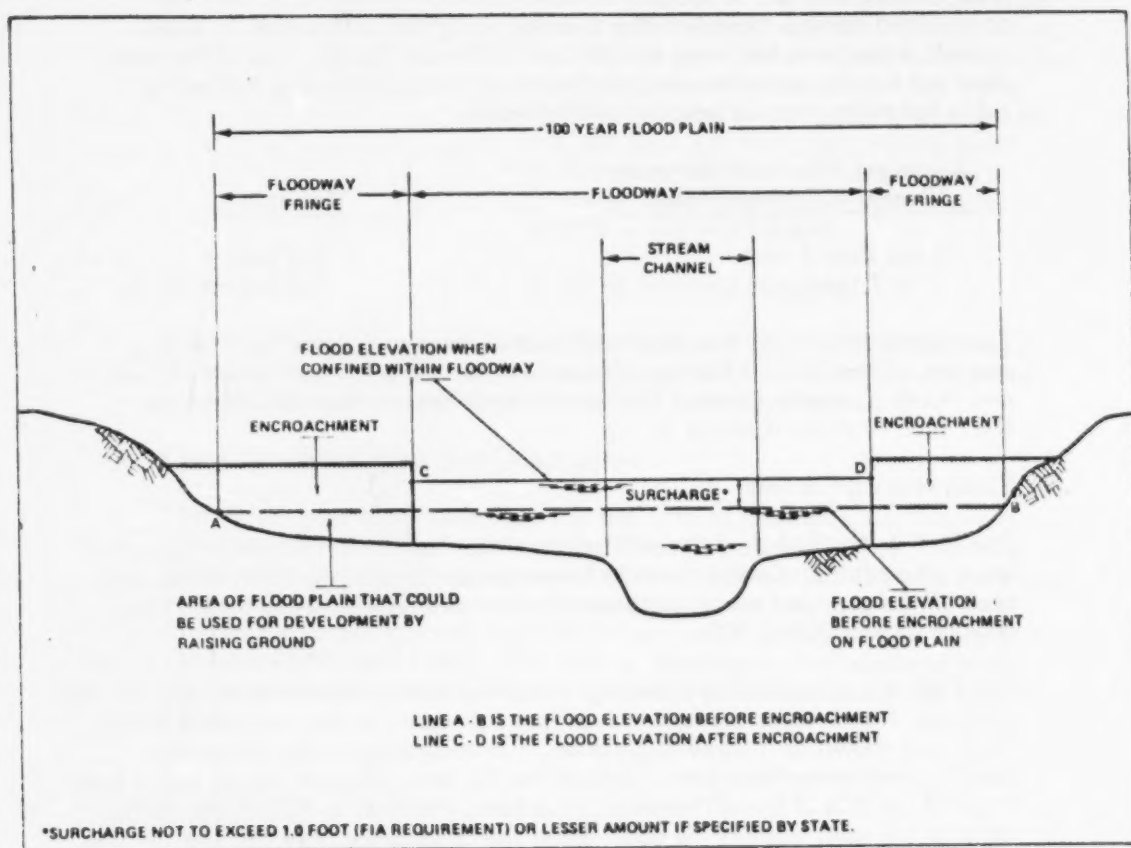
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FLOODWAY DATA

NORTH CARRETTA CREEK

TABLE 2



FLOODWAY SCHEMATIC

Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF's), and flood insurance zone designations for each flooding source studied in detail affecting the community.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

<u>Average Difference Between 10- and 100-Year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

Two reaches meeting the above criteria were required for the flooding sources of the City of Bishop. These include one each on Carretta Creek and North Carretta Creek. The locations of the reaches are shown on the Flood Profiles (Exhibit 1).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF's are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the entire area of the City of Bishop was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zones A2, A5:

Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF's.

Zone B:

Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C:

Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Bishop is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

No other flood reports have been prepared for the City of Bishop. The data presented here is authoritative for the purpose of the Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, Federal Center, Denton, Texas 76201.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION ³
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Carretta Creek Reach 1	0001	-2.5	-0.7	+1.6	025	A5	Varies
North Carretta Creek Reach 1	0001	-1.2	-0.3	+0.8	010	A2	Varies

¹FLOOD INSURANCE RATE MAP PANEL
²WEIGHTED AVERAGE
³ROUNDED TO NEAREST FOOT-SEE MAP

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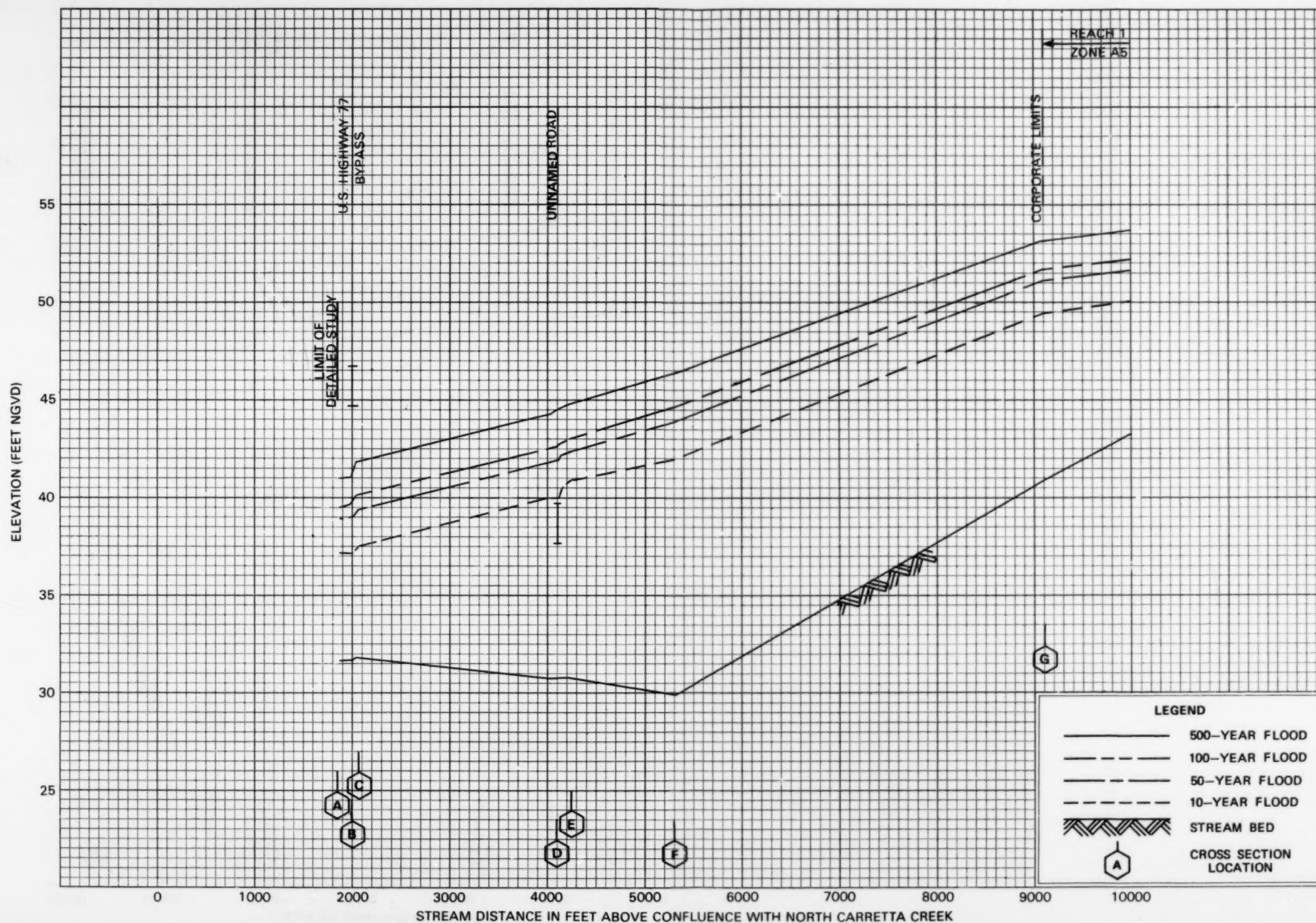
FLOOD INSURANCE ZONE DATA

CARRETTA CREEK—NORTH CARRETTA CREEK

TABLE 3

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4. U.S. Army Corps of Engineers, Hydrologic Engineering Center, Computer Program 723-X6-L202A HEC-2 Water-Surface Profiles, Davis, California, December 1968 with updates.
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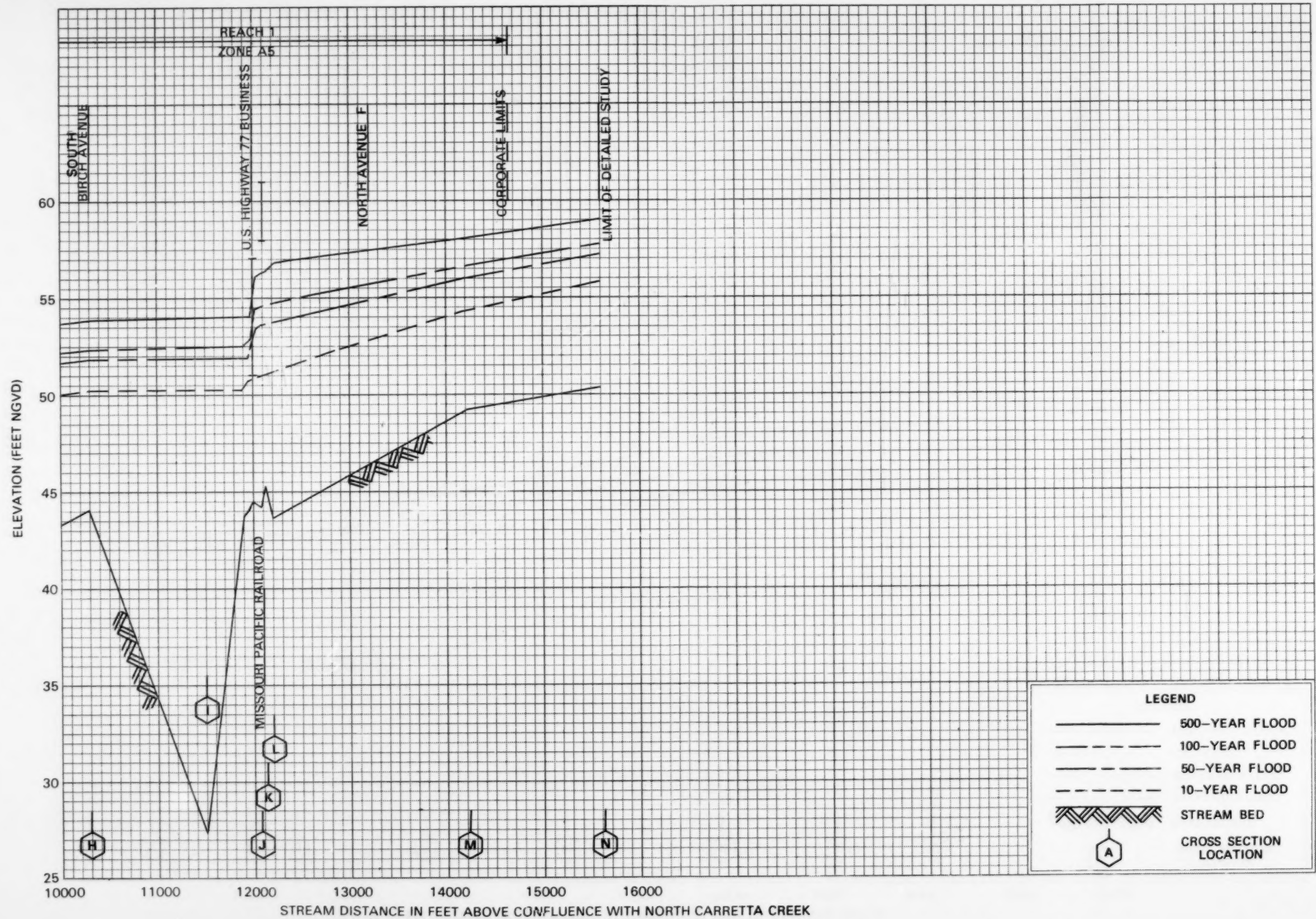


FLOOD PROFILES

CARRETTA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF BISHOP, TX
(NUECES CO.)



FLOOD PROFILES

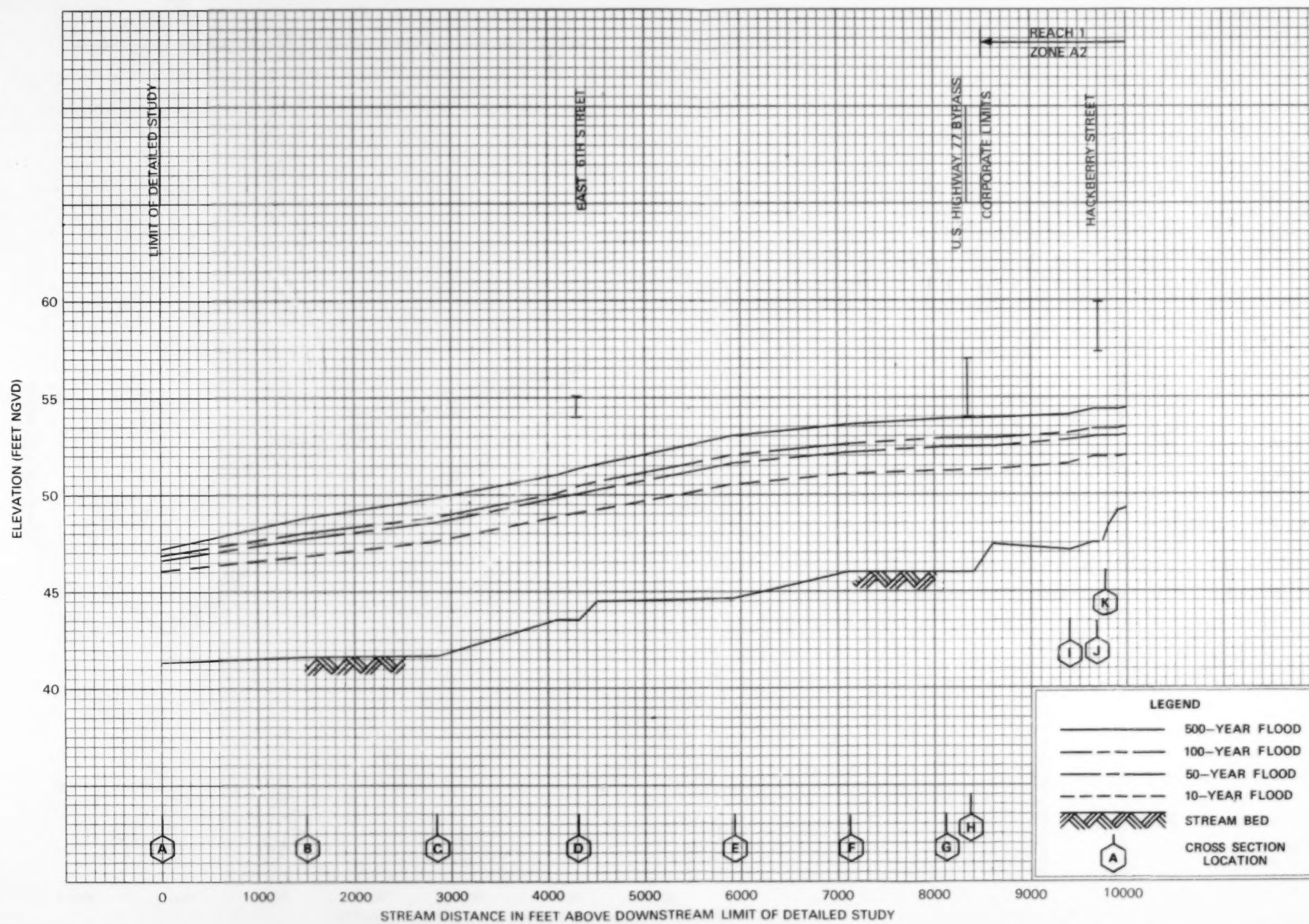
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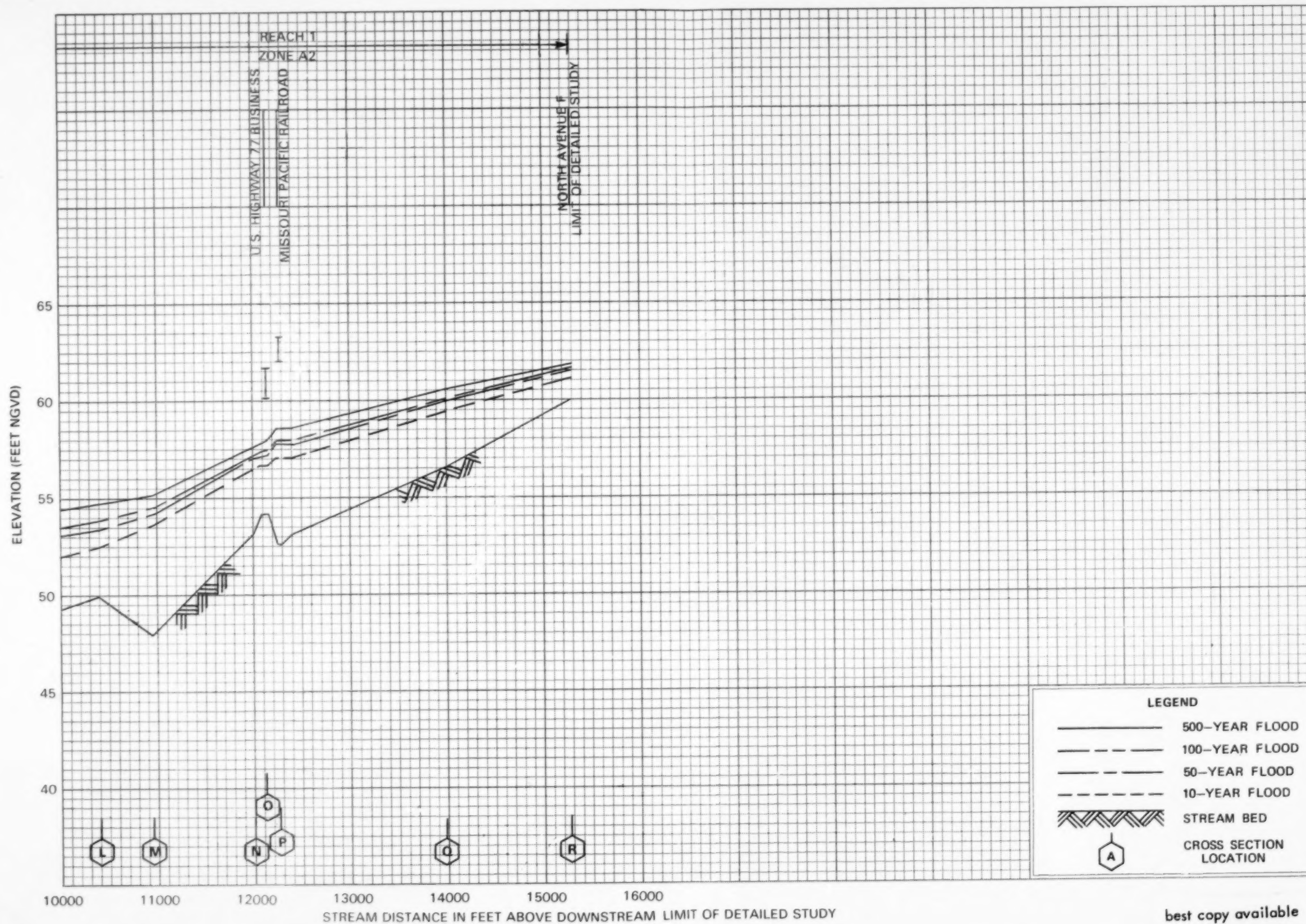
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